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ABSTRACT

Three aspects of organization -- structure, resources, and leadership attitudes -- were examined in a longitudinal study of 16 health and welfare agencies to determine which factors best predicted the rate of program innovation. Study results revealed that occupational specialization was the strongest structural predictor, that professional activity was the most important resource variable, and that positive change attitudes of the elite were the most important leadership variable. Multiple correlation of these variables accounted for 60 percent of the variance. (RA)

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THE PREDICTION OF ORGANIZATIONAL PERFORMANCE:

THE CASE OF PROGRAM INNOVATION

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BIOGRAPHICAL SKETCH

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THE PREDICTION OF ORGANIZATIONAL PERFORMANCE: THE CASE OF PROGRAM INNOVATION

Given the events of the last decade, it is not surprising that there is a renewed interest in the subject of organizational change. It is just one more aspect, albeit an important one, of future shock (Toffler, 1971, Chapter 7). If we are to make our own lives more predictable and thus more sustainable, we have to understand what may be some of the causes of organizational change and be able to predict its pace. This is one task of our long term panel study of organizations and this present report. In considering the problem of change in organizations, it seems to us there is one dimension that is particularly critical: program innovation.

There is no doubt that the environment has become increasingly complex for most organizations because of mushrooming technological developments and specialization (Lawrence and Lorsch, 1967, Terreberry, 1968), although this does not deny that there is still great variation in organizational environments (James Thompson, 1967). The ability of an organization to adapt to these changes means not only its survival, but, more importantly, the continued existence of the services and or products rendered by the organization to the community. This is especially crucial in the case of organizations such as those to be dealt with in this study whose function it is to solve the social problems stemming from the increasing complexity of the environment. The organizations in the research reported herein are health and welfare agencies which frequently have been given the task of sweeping up in the wake of industrialization, urbanization, and other broad-scale societal changes, the headaches of our modern age.

The purpose of this paper is to report our successes and failures in attempting to <u>predict</u> rates of organizational innovation in sixteen

health and welfare organizations in a large midwestern city. Prediction studies, especially for organizational studies, are quite rare; the work of Morse and Reimer (1956) and Seashore (1963) are two notable exceptions. The reason for the lack of such studies is usually the result of the long time periods involved and the cost which multiplies with each wave of data collected. The present study has taken six years of research time and covers a total of eleven years in the biographies of our organizations.

Despite their rarity, prediction studies have certain theoretical advantages. They are perhaps the most stringent test of a hypothesis. There is something about the testing of hypotheses across time that makes one aware of their limitations. Linear models become more suspect. Predictions do not always work because some excluded variables are more important, an importance not necessarily discernible in cross-sectional correlations. Finally, making predictions in an environment that is itself in a state of flux--the real world, with all its historical events and unique factors--makes one suspicious of the assumption, "all other things being equal." For these reasons, prediction studies have some advantages.

In all our previous work we have been primarily concerned with the impact of structure on program innovation. So therefore our first task is to explore how well structure predicts innovation across time. But structure as a causative factor can only be understood in juxtaposition with several other major classes of variables; what we call resource variables and elite attitudes (Stinchcombe, 1965). And there is another consideration as well. In prediction studies, one is interested in maximizing the coefficient of determination. This is best done by adding variables that tend not to have high intercorrelations, the typical instance when dealing with different classes or domains of variables. Finally, we also explore the impact of past organizational behavior, in this instance its history of program innovation, as a predictor of future performance.

The foregoing discussion assumes that the definition of innovation is clear and unambiguous, but this is not completely the case. There are two principal questions which must be answered before some activity in an organization can be considered innovative. First, there is the question of whether the activity is actually new and second, the magnitude of its consequences for the organization and its environment. It is intuitively easy to rule out as inconsequential adjustments in rules or slight product modifications; but should one consider whole new sets or procedures, new products, or major personnel turnovers as significant kinds of change?

Several definitions of innovation have been offered and there is little consensus about its exact meaning. In the study of organizations, innovation has been used to refer to the first use ever of a new product, process, or idea by any organization, with subsequent uses being called imitation (Mansfield, 1963); to the first or early use of an idea by one of a set of organizations with similar goals (Becker and Whisler, 1967); and to the first use ever of a new procedure, product, service, or idea by a given organization (Evan and Black, 1967; Mohr, 1969). We define innovation in this latter sense as "... the generation, acceptance, and implementation of new ideas, processes and products or services ..." for the first time within a given organization (Thompson, 1969, page 6). Mansfield's and Becker and Whisler's definitions are rejected since their focus is more on the innovation and not enough on the organization adopting it. Their definitions would have some utility, if one were examining the history of some particular invention. Since the object of analysis in this study is the individual organization, innovation new to the particular organization will be our interest. We are concerned with innovations that have been successfully incorporated into an organization's structure, although they might conceivably be discontinued at some later point in time. The definition of innovation used here does not solve all problems. There is still the question of how one operationalizes this concept, a point to which we return below.

The magnitude of the consequences (or costs) of innovation is difficult to pin down. Specifications here must be vague. The adoption of a new program or service, the kind of innovation which will be considered here, implies costs to the organization's resources and consequences for a wide range of organizational dimensions. To initiate a new program will often require a change in the organization's other programs, different configurations of authority and communications patterns, and especially a redistribution of resources or a campaign to generate new funds. These consequences of the adoption of new programs imply that this is a fairly significant undertaking for an organization often involving some risk. What also will be of interest are the factors inducing an organization to undertake such a change.

THEORETICAL FRAMEWORK

A. Structural Correlates of Innovation. Our ideas on the nature of structural arrangements conducive to innovation have already been presented in some detail (Hage and Aiken, 1970; Aiken and Hage, 1971) but will be represented here in summary fashion for the sake of clarity. The key notion is that the organization must have a certain kind of structure, one that stimulates creativity and then permits this creativity to be expressed and implemented. The key variable that stimulates creativity and provides the organization with ideas of novel methods of proceding is complexity.

We consider the critical component of complexity to be the diversification of knowledge. In particular this implies that many kinds of ideas, diverse methods for accomplishing tasks, various procedures, etc, are each spread throughout the different divisions of the organization. Hall (1967) has presented a much broader notion of complexity which encompases several different indicators including a complex set of goals activities, departmental divisions and subdivisions, authority structure, dispersion of the physical location of the plant and its subunits, and location of personnel. We have decided to limit outselves to the notion of complexity of knowledge as defined because it is the clash of different occupational perspectives and their struggles for power that we feel are most likely to lead to the development and implementation of new programs.

Victor Thompson (1965, page 2) has emphasized the need for a diversity of inputs in order to accomplish both the proposal for and implementation of innovation in organizations. The greater the pool of ideas in an organization, the greater the cross-fertilization of ideas--the source of creativity--thus the greater the proposals for new techniques, procedures, and services. Complexity also means diversity of occupational interest groups (Hage and Aiken, 1970). Elsewhere we have argued that out of this diversity comes a struggle for scarce organizational resources (Ibid; Burns and Stalker, 1961) which in turn inevitably forces organizational elites towards program innovation. The new products or services and the mechanism by which an organization and an occupation can justify obtaining more resources. Furthermore, occupation groups, each with a different intellectual training and experience, and thus different perspectives and prejudices when added together, go a long ways toward preventing what March and Simon (1958) call the limitations of cognitions and perceptions. Each professional group is plugged into the social world in a different way.

Burns and Stalker point out that mere numbers of diverse types of professionals are not a sufficient condition of innovation, but that an integration of their tasks into a coherent program must also be present (Burns and Stalker, 1961, page 121). Even if the organization has a great number of professionals on its staff, then, the way in which they are arranged in the organization is a powerful determinant of whether or not their innovative ideas will be accepted. If they are isolated from the power structure, or if they are hindered by rules and regulations, innovative suggestions from the professionals--let alone from anyone in a similar position--may be easily ignored by the organization's elite. Burns and Stalker offer as another characteristic of an innovative organization the fact that authority is spread among the members in a network fashion, instead of being concentrated in one position, and that there be lateral channels of communication available to all, as well as no rigid definitions specifying performance characteristics on tasks (Burns and Stalker, 1961, page 122). Greiner has suggested a direct relationship between successful adoption of new programs and the widespread sharing of power as well as the absence of the bureaucratic characteristics

of formalization (Greiner, 1967, page 121). Blau notes as a factor directly affecting the adoption of new programs, the absence of rigid conformity to rule enforcement (Blau, 1963, pages 235-245).

Structural looseness such as latitude in work roles, minimal stratification of prestige and rewards, and the dispersion of social power have been suggested by Victor Thompson (1965) as being a necessary ingredient for innovation in organizations. He suggests that concentrated power arrangements prevent imaginative solutions to problems. Dispersed power arrangements can contribute to the implementation of innovation because it makes possible a variety of sub-coalitions, thus expanding the number and kinds of possible supporters and sponsors (James Thompson, 1967; Chapters 9 and 10).

Drawing on the above literature, the structural profile of an innovative organization might be as follows. It is one with many diverse kinds of professionals. The power structure of the organization is decentralized such that these professionals and others are brought in on the decision-making process, and the organizational procedures are not highly specified by rules and regulations. (For an extended discussion see Aiken and Hage, 1971).

Although there is considerable support for the contention that the organic model is most conducive to innovation, accepting our explication of its properties, it would be incorrect to assume that this is necessarily all that one needs for innovation. In other words, the complexity of the real world always suggests that there are many factors, many more than those discerned by Burns and Stalker. In particular, the organic model is described primarily in terms of structural and process variables with the accent on the arrangement of jobs and the communication channels between them. Little is said about attitudes and resources other than those of ideas that might be available to the organization and how this might effect innovation rates. It is some of these other characteristics including the where-with-all to pay for change that we would like to explore now.

B. Resource Correlates of Innovation. In previous work we considered professional training and professional activity as additional indicators of complexity. But it is more correct to say that they represent measures of how much information is included in the organization; an input of knowledge might be an apt name. This is somewhat different from the concept of technology, routine or otherwise (Perrow, 1967, 1970; Hickson, et al. 1969; Woodward, 1965) which has attracted so much attention recently. Professional training means the learning of ideas and techniques whereas professional activity means the acquiring of new ones. And it is the latter that most clearly represents an input into the organization, something different from the structural question of how many different professions there are. The development and maintenance of affiliations outside the organization, which is implied by professionalism, is very important for the infusion of new ideas. Wilson (1966) has outlined the importance of professionalism for innovation in an orgnization. To the extent that professionals bring long training as well as outside reference groups into the organization, they contribute to organizational diversity, and, hence, to innovation in organizations.

One of the most often observed findings about organizational innovation is that it is positively related to the size of an organization, whether size is measured in terms of number of employees, budget, or some other feature of the organization. Size implies the availability of more resources, but it also may imply many of the factors previously discussed such as number of occupational specialties. The effect of organizational size on the rate of innovation is one of the most often observed relationships in the literature on organizational innovation. The studies of Mansfield (1963), Becker and Stafford (1967), Carroll (1967), Mytinger (1968), and Mohr (1969) all found relatively strong positive relationships between organizational size and the amount of innovation. Only the study by Evans and Black (1967) failed to find a strong relationship between these factors.

This variable is quite difficult to interpret, however, since sheer size can mean a number of things. A large contingent of secre-

taries, unskilled hospital attendants or volunteer help do not automatically imply anything about the diversification of the organization's resources and consequently about the bearing of these resources on the output of innovation. For that matter, neither do the resources of money, advanced technology, or space. These may be necessary conditions of innovation in the sense that it is difficult to do some things without them, but their mere presence implies nothing. It all depends on the use to which they are put.

C. Elite Attitude Correlates of Innovation. Besides the resources of ideas and size and the structural variables of complexity, centralization, and formalization, there are the attitudes of the elite. It is conceivable that the old ways of providing services are seen as more trustworthy than anything novel, or that new programs are to be rejected (or sabotaged) a priori because they appear to involve too much risk. Conversely, an elite in favor of change may be willing to stretch scarce resources to the limit to hire more specialists or to subvert and bypass lines of authority in order to bring about change. If we make the assumption that the elite in an organization does have some control over the organization's policies and performance and if we assume they try often to act in accord with their attitudes toward change, then if these attitudes are favorable to change, one would expect the organization to adopt more new programs.

Here it should be noted that this argument is at odds with what we have suggested previously (Hage and Aiken, 1970). Our concern here is to test alternative lines of reasoning and insofar as possible make our analysis more complete. At this point it does not seem at all wise to rule out one or other of these classes of variables as unimportant to innovation, despite the fact that a great deal of literature deals only with one or other of them without combining both. A cursory glance at the early works of Scott (1964), Gouldner (1959), Udy (1962), Etzioni (1961), Aiken and Hage (1971), and Hage and Aiken (1970) reveals an emphasis on structural features of the organization such as specialization, communications networks, the hierarchy of authority, work groupings, and the like. On the other hand, March and Simon (1958), Blauner (1960), and Blau and Scott (1962) have tended to explain individual behavior and to

see the organization as the individual's environment. They concentrate on the individual's attitudes, his relations with other workers, and his morale. There are also examples of the same author using both kinds of variables (compare Blau, 1962 with Blau, 1971).

The question of the relative importance of elite attitudes versus structure in predicting innovation is most complex. Plausible arguments could be made for the primacy of each. Unless they can acquire enough resources along with a structural arrangement at their disposal such as diverse occupations and flexible lines of authority, one might feel that the attitudes of the elites will have little relation to innovation, no matter what those attitudes are. On the other hand, one may think that an elite sufficiently convinced of the need of change would be able to manipulate the structures in its own organization and introduce men with new ideas and encourage professional activity on their part. Finally, one can see these as alternative approaches to the development of innovation. The contrast between them is perhaps one of the oldest problems in the sociological literature: structure versus values. Here we are relating it to a critical organizational performance: program innovation. Also we are suggesting that what may be critical is the elite attitudes and not the rank and file's.

RESEARCH METHODOLOGY

A. Research Design. Our concern with this task of predicting change, however, really started from a methodological consideration. We had reported in the literature a test of some hypotheses from an axiomatic theory (Hage, 1965) in an article entitled, "Program Change and Organizational Properties" (Hage and Aiken, 1967), but innovation in that article was measured prior in time to the organizational characteristics. Theoretically there is no concern because the axiomatic theory is composed of a set of interdependent hypotheses: for example, increases in complexity lead to greater innovation which in turn increases complexity, etc. But empirically, the results could be quite different. So we decided to use the same organizational variables measured in 1964 to predict innovation during the period 1964-66. We did this and the results were encouraging,

so we replicated the study by again measuring the same set of organizational characteristics in 1967 and program innovation for the period 1967-69, inclusive. Our desire to replicate was dictated by several considerations. If we found the same basic pattern of findings, then we could have more confidence in our results. This is especially important given the small number of organizations, namely sixteen. More importantly, most of our organizations were concerned with physical or psychological rehabilitation. During the period of 1964-66, a large amount of money flowed into mental retardation in particular and rehabilitation in general, primarily because of the interest of the Kennedys'. We felt that some of our high correlations might be due to just this factor--a chance event in a changing world that in this particular case helped and did not hinder us. Consequently we did not report the findings of this first prediction study.

B. Problems of Measurement. Before we discuss our findings, some brief discussion of the measurement techniques employed for these variables is in order. With each of the three time points we attempted to improve the quality of our measurements, especially for our dependent variable, program innovation.

(1) Measuring Program Innovation. This was operationalized by asking the executive directors in each of our sixteen organizations how many new programs or services were implemented during the previous three years. (None of our organizations produce products as their main goal.) Since we had asked the same question in 1964, we were able to determine precisely dates whenever there was any problem of recall. This question was followed by a whole battery of follow-up questions concerning the number of staff involved, sources of funding, the nature of the activities involved, the kinds of clients served, the sources of the new ideas, whether other organizations were involved, etc. The point of all these questions was to determine whether the new program was indeed new for the organization and not an expansion of existing services.

The following examples are offered to illustrate the boundary between new and old programs. In other words, when is an innovation an innovation? One organization added a stroke clinic to its line of physical rehabilitation services. The treatment of stroke patients seems to us clearly a new

activity, different from the treatment of cardiac patients. Another organization added an adoption program for black unwed mothers. In this case, it was a family agency which had an adoption service. Is this old or new? We coded it new because the agency moved into the ghetto to provide the service and because it was for them a new client; they had never handled blacks before but serviced only Catholic unwed mothers. In contrast, we did not count the addition of medicare clients to a public welfare department because all this agency did was determine eligibility. Thus the activity remained the same. Similarly, even though there might be new sources of funding, this was never counted as a new program unless there was a new activity, or, at a minimum, a new client, which required special handling. Likewise, the addition of new buildings was not counted.

While these decision rules handled most cases, there were still some problems, one of which emerged in an organization with a rapidly expanding research department. Does one count new research projects as new services? We did not because a project is of short duration and furthermore does not necessarily involve a service to clients. If the project moved from a research status to a service program, then it was counted. One other criterion was applied implicitly in the coding, namely, the program had to be operative continuously for some period of time. An organization providing a service for a day or two, for example, taking care of babies on voting days, would not have such an activity considered a new program.

Our attempts to operationalize the other dimension of innovation, the magnitude of its consequences for the organization adopting it, met with limited success. To operationalize this notion we tried to determine the amount of money invested in the new program at its inception. But this was impossible. Cost accounting does not exist in these kinds of rehabilitation agencies.

We did measure the number of new staff members assigned. In general, most of the some 200 new programs we have dealt with in the past eleven years, including the first period of 1959-63, start small and then often grow. In only a few cases did a new program involve large numbers of staff. One example of this was a mental hospital that added a day-care community health program. In this instance, it involved the entire staff. But this

is the exception and not the rule and for obvious reasons. Innovation is a risk. Organizations, therefore, often start with minimal commitments.

One other problem arose in assuming the number of new programs adopted operationalized the willingness of an organization to innovate. Might not an organization which adopted several new programs minimize disruptive consequences and strain on its resources by dropping several old programs? In such a case, the number of new programs, while in a limited sense a change, in the broader sense would not operationalize innovation. A check was made on the organizations in the study, however, and no organizations were found dropping old programs with the addition of new ones. One exception to this was an organization whose budget was cut by more than one-third in less than a year. Although several programs were eliminated along with a much larger number of staff, what is interesting about this extreme example is that this organization cut staff from all programs rather than jetison particular ones. Seniority rules are an obvious factor, but perhaps even more important is the point that programs are services and organizational elites are reluctant to let them be dis-continued. So again, the qualification of some net score does not seem necessary.

(2) Measuring Structure. As has been stated, the most critical variable for innovation is that of complexity. Our procedure was to ask each respondent to report what was his primary work activity and the name of his job. These were coded in terms of major professional activities. As a check on this procedure executive directors were given a list of professional specialists and asked to indicate which they had. The correlations between the two procedures were .97. (For more elaborate discussion see Aiken and Hage, 1968.)

The measurement of centralization of power presents innumerable problems, largely because of the slippery nature of concepts such as power and control. At issue is the rather simple question asking who it is, if anyone, that determines what the organization shall accomplish (what goals it sets for itself, what products it will provide, who it will service, etc.) and what means will be taken toward its ends. There are two major strains running through the literature concerning the measurement of power in organ-

izations. The first concentrated on the formally defined power networks or hierarchies of authority and the second on the more intangible, yet perhaps more real, aspects of power, viz. influence. Pugh (1963, 1968) and Blau (1970) have concentrated on the former. Their measures attempt to ascertain at what formal level in the organization decisions are made or with which of its officials ultimate responsibility rests on a given issue. The second, exemplified in another work of Blau (1971), Tannenbaum (1968) as well as our own previous work (Hage and Aiken, 1967), seeks to determine who it is in the organization that is making key decisions.

Here the strategy is to prepare a list of critical decisions such as those dealing with the hiring and promotions of personnel, the adoption of new policies, programs and services, decisions on the allocation of the budget, etc. (See the appendix for a complete list of the questions used for this measure.) All respondents in the organization are then asked to state to what degree they participate in such decisions. We believe it can be safely assumed that at least the dispersion of important decision making is captured by this index. Whether this is coterminous with the actual power network in the organization is still problematic. It is quite conceivable that certain power sources never have to participate in the decision making process because they know their views will be considered by those involved. The other major problem with this measure is that it neglects the implementation of the decisions and it is here that obstacles may be thrown up by "lower" (or even higher) participants which will determine the organization's activities in ways not intended by its decision makers. To empirically check either of these difficulties of the measure would be an extermely costly procedure entailing a great deal of participant observation. Since this was impossible in the present study, we shall have to remain content with the participation measure. At least it represents some improvement over the measures dealing with formal authority which are even one step more removed from the actual power relationships that determine the organization's activities.

So far the discussion of the distribution of power in the organization has centered around the notion of large scale determination of the whole organization's activities. There is also another dimension of power in the

organization which might be termed the hierarchy of authority, i.e., the extent to which discretion is not allowed the staff in making decisions about their individually assigned tasks. An index has been constructed here to measure the degree to which the organization's members had decisional power in their own work. Respondents were asked if they could not make most of their own decisions on the job, whether decisions had to be referred to supervisors, etc. (The complete battery of these questions appears in the appendix.) The phenomena indicated by positive answers to such questions is unclear. It may be that something is being said about the distribution of control over the performance of one's job in which case there should be a moderately positive association between this and innovation, especially when professionals are involved. On the other hand, lack of discretion on such matters may only reflect bad management techniques or attempts by the organization's leadership to "tighten up the ship" after some period of disruption. In this case they may not hinder innovation severely, but may well be its consequence.

Part of the structural looseness referred to by Victor Thompson (1965) includes flexibility and looseness of work roles. He as well as Burns and Stalker (1961) have emphasized that the freedom from rigid rules and narrow definitions of the rights and obligations of work roles are necessary conditions in the innovative organization. In our study we included one aspect of the use of rules as mechanisms of social control. An index was constructed reflecting the number of rules and extent of job codification. (The construction of this index is given in the appendix.) The conceptual relationship between the presence or absence of job codification and the amount of subsequent innovation is not totally clear. It could be argued that innovation occurs in spite of them and frequently because of restrictions they produce. It is also moot whether they actually restrict as much as their authors intend them to. Our findings appear to indicate that they are more consequences of rapid innovation. We measured rule observation by attempting to ascertain the extent to which employees were monitered for their observance of rules. (The measures of this variable appear in the appendix.)

(3) Measuring Resources. There are several variables which may be considered resources conducive to innovation. The length of professional training and the amount of professional activity were measured by asking each respondent their past history of education and present involvment in professional associations. Indices were constructed on the basis of this information. (See here the appendix for measures of these variables.)

Size has also been discussed as a resource. The measurement of size produced some difficulties. Organizations in our study were found to hire many people part time and to accept several forms of volunteer services. We decided somewhat arbitrarily to score each full time employee with one, all part time help with one-half, and all volunteers with one-tenth. The natural logarithm was taken of the resultant scores to reduce the range among them since we had a skewed distribution.

(4) Measuring Elite Attitudes. In our measures we included several batteries of attitude items developed by Neal for a study of dioscesan clergy in Boston (Neal, 1965). The intent was to contrast the predictive strength of this kind of variable with the structural variables already mentioned. One of the attitudes measured was that of one's opinion toward change and its risks. Positive responses to the items in this index (which is presented in full in the appendix) would imply that one thought something about change was refreshing, that his primary convictions would influence him to devote himself to change movements, etc.

How does one determine who are the elite? There should obviously be more emphasis on those who actually make key dicisions than on those who are merely in a position to do so. Using the index of participation in decision making described above enabled us to arrive at a behavioral definition of the elite. We somewhat arbitrarily set the bounds of the elite to include only those who always participated in all of the decisions listed. (See the appendix for the index used to measure participation in decision making.) Those who "usually" or"sometimes" participated in decisions and those who always participated but only in a limited number of decisions were excluded. An examination of participation scores reveals that most of the members of the elite as defined by formal position, such as the executive director and department heads, do participate in key decisions,

but this formal method of defining the elite is inadequate since some of them do not participate and especially because many of those who do participate are not in positions that are defined in the formal elite. (For an extended discussion of this topic, cf. Dewar, 1971.)

FINDINGS

Our data indicates that the most important structural predictor of innovation is the number of occupational specialties. (See Table I.) This variable has strong effects in both time periods and its predictive strength remains undiminished no matter which other variables were used as controls. The 1964 measures of participation, hierarchy of authority, job codification, and rule observation have weak relationships with innovation rates in the subsequent years, although all but rule observation are in the predicted direction. These variables measured in 1967, however, do not have comparable relationships with innovation during the period 1967 to 1969. The 1967 measure of hierarchy of authority is positively associated with previous rates of innovation ($r. = .63^{**}$) while the 1964 measure was not ($r. = .09$). Our interpretation is that the use of hierarchical controls may have been necessary where innovation was too rapid. The rate of innovation in the period 1964 to 1966 was twice that in the 1959 to 1963 period; the average number of new programs adopted per organization per year was .97 for the former period and .57 for the latter.

Perhaps the most surprising finding in Table I is the lack of a relationship between participation in decision-making and innovation. In our first study (Hage and Aiken, 1967) this measure of centralization had a strong relationship with the rate of previous program change. But as a predictor it is weaker, and in the replication of 1967-69 the relationship almost disappears. Again our interpretation is that centralization is more a consequence than a cause. For those who have emphasized power as the key organizational variable, this may come as a bit of a surprise. Of course, it does not mean that centralization is more of a consequence than a cause vis-a-vis other kinds of organizational performances such as morale where it has played a prominent part in the literature (Tannenbaum, 1968).

The most important resource for predicting innovation is professional activity and not size. (See Table II.) Neither size nor professional training

are related to innovation rates in either period. The prediction of professional activity is undiminished when size and professional training are controlled. Given the relative importance of size in the literature on innovation, this is another interesting finding. It indicates the difference between a longitudinal and a cross-sectional design. We do believe size is an important variable but not necessarily for predicting innovation. There has been a confusion between size and complexity. They are correlated in cross-sectional studies. Our findings, however, indicate that it is complexity and not size that is important in predicting innovation <u>across time</u>.

The attitudes of the elite in favor of change is an important predictor of innovation. (See Table V.) This was a serendipitious finding which we discerned upon reanalysis of our data. In a previous analysis we found no relationship between innovation in the period 1959 to 1963 and attitudes of the entire staff of the organization in 1964. Reanalysis has shown that only the attitudes of certain members are important, viz. those of top decision makers. While everyone in the organization may have an opinion about change, it is the powerful few who are able to translate these opinions into action. What is especially interesting is that other definitions of the elite boundary, that is operational ones, do not work as well. As the elite is more and more broadly defined to include those who participate frequently, the prediction weakens. A formal definition also does not have much impact (see Dewar, 1971). This argues that an elite is a real phenomonon and how it is measured is of critical importance. To measure the average attitude in an organization, as we did in our first study, is of no value at least for this problem of predicting innovation. Even more interesting is that it does not predict backwards in time very well. This raises the question of just what might be the causes of elite attitudes towards change.

We now need to consider the alternative power of our three approaches to predicting innovation: structure, resources, and elite attitudes. The structural property of diverse occupational specialties appears to be a stronger predictor of innovation than any of the resource variables, although both of these kinds of variables have an impact on innovation rates. (See Table IV.) Its effect as a predictor is not diminished when the two

strongest resource predictors are controlled. This indicates that complexity, the diversity of occupational specialties, a dimension of structure is a better predictor than those resources we have measured. Because professional activity is related to the number of occupational specialties--suggesting that diversity does stimulate professionalism and vice versa--there is little improvement in prediction where the two variables are combined. Furthermore their impact together is greater in the first prediction than it is in the second.

When we examined the combination of complexity and professional activity with elite attitudes towards change, then we found a more intriguing prediction model. The effects of both of these predictors are attenuated when controlled by the elite's attitudes toward change. These change attitudes are very powerful predictors and combinations of them with either the structural or resource correlates are capable of explaining around sixty percent of the variation in innovation rates. When these attitudes are combined with professional activity and the number of occupational specialties, sixty percent of the variation is explained. (See Table VI.) As would be expected, the effect of size disappears when these other variables are controlled.

Elites, which favor change, take definite steps to bring this about. They are likely to hire more diverse kinds of personnel for new projects (the correlation between the attitudes of the elite favoring change measured in 1964 and the percent increase in the number of occupational specialties from 1964 to 1966 is .70***), and they attempt to obtain new funds for their organization, presumably to pay for new programs (the correlation of the 1964 elite attitudes favoring change and the percent increase in the budget from 1964 to 1966 is .63**). We have not found that the elite's attitudes favorable to change are related significantly to any structural properties or resource variables (including professional activity and training) measured in 1964 suggesting some other source which we have not tapped. These attitudes are also unrelated to past innovative performance. Unfortunately, because our first analysis had concentrated on the entire staff's attitudes and this was unrelated to innovation, we did not replicate. Therefore it is possible that elite attitudes towards change might

not have worked as well in the second time period when sources of funds were drying up. But the size of the correlation makes it a variable well worth further investigation.

We have discovered that rates of innovation in one period of time predict to those in the next suggesting that organizations evidently engage in roughly similar patterns of behavior over the years. The organic organization would then seem to remain organic. On a purely pragmatic basis, we have included in our results the correlations of the history of innovation and subsequent innovation controlled by the other predictors we have discussed. (See Table VII.) The results indicate that it is a very powerful predictor, which has more impact on subsequent innovation than any other variable with the exception of elite attitudes favoring change. These two variables alone, the attitudes of the elite and the history of innovation, explain sixty-seven percent of the rate of subsequent innovation. Again we can not report a replication. When third order multiple correlations were computed, the attitudes of the elite and the history of innovation retained their strength as predictors, and when they were joined with either the resource variable of professional activity or the structural variable of diverse occupational specialties, seventy percent of the variance in subsequent innovation was explained.

CONCLUSIONS

The elite's attitudes in favor of change as well as structures and resources are important predictors of innovation. These predictions are further strengthened with the addition of past rates of innovative performance. Together they explain a high degree of the variation in innovation. But, how does one judge the relative success or failure of this attempt at prediction? One standard that can be applied is what has been achieved in other studies. Perhaps the studies closest to our own are the prediction studies in the diffusion of innovation literature (Rogers, 1962). In these studies seldom has more than fifty percent of the variance in innovation been explained, and it usually required more than two variables to do this. By this standard our own study compares quite favorably. Of course, we realize that the organizations in our study are a relatively homogeneous group and that consequently there will be less noise interfering with our

prediction, hence our greater success in explaining variance in innovation, one reason why replication is such an important part of our research design.

The partial correlations indicate that elite attitudes favoring change are slightly stronger predictors than structural properties or resources, although both are important. This lends some support to the view that elites are not totally determined by the kind of organization they lead, but are able to manipulate their organizations, at least in the case of innovation. It is unfortunate that these attitudes were not measured in 1967. If we had such a measure, one might speculate that a weakening of attitudes favorable toward change might have occured because the rate of innovation between 1964 and 1966 was double that between 1959 and 1963. This weakening of attitudes in favor of change could be related to efforts by the elite to reassert their authority and eliminate disruptions caused by rapid innovation between 1964 and 1966 through the increased use of hierarchical means of control. Alternatively, such means of control could be measures the elites found necessary to insure the acceptance of innovation. These conclusions suggest a need for further investigation of leadership styles and of attitudes within the organization as predictors of its performance in many areas besides that of innovation. They illustrate most clearly that both attitudinal and structural variables may be useful in explaining innovation.

The importance of longitudinal studies of organizational performance is also apparent. Cross-sectional analysis is not capable of showing the diminishment of effects of some variables over time as well as instances in which performance may be explained by one kind of variable at one point in time and another at another. Among other findings, the lack of a relationship between size and innovation contrary to much of the literature, and the appearance of centralization and formalization as more consequences than cause give us at least food for thought indeed. We are now presently engaged in an extensive analysis checking the consequences for organizations of different rates of growth, whether measured in terms of size, complexity, or new programs. From this may emerge a better understanding of the dynamics. It is conceivable that an elite favoring change may be able to so structure its organization that even if they are replaced, subsequent leaders would be

unable to reverse innovative patterns. Only longitudinal studies would detect such a case. Finally, we recognize that the predictive validity of this study should be checked by replications in additional points of time and by an increase in the sample size. But most of all, we need more longitudinal studies to determine if cross-sectional correlations hold up across time. Some of ours did not!

TABLE I

STRUCTURE AS A PREDICTOR OF INNOVATION

Zero Order Correlations

Structure 1964	Program Innovation 1964-66
Complexity (occupational specialties)	.63**
Centralization	
Participation	.33
Hierarchy of Authority	-.10
Formalization	
Job Codification	-.16
Rule Observation	.07

Structure 1967	Program Innovation 1967-69
Complexity (occupational specialties)	.53*
Centralization	
Participation	.06
Hierarchy of Authority	.46*
Formalization	
Job Codification	.24
Rule Observation	.21

Partials	Program Innovation 1964-66	Program Innovation 1967-69
Occupational Specialties and	.59**	
Participation '64	.20	
Occupational Specialties and		.56**
Participation '67		-.20
Occupational Specialties and	.63**	
Hierarchy '64	-.15	
Occupational Specialties and		.50*
Hierarchy '67		.42
Occupational Specialties and	.63**	
Job Codification '64	-.11	
Occupational Specialties and		.55**
Job Codification '67		.32
Occupational Specialties and	.63**	
Rule Observation '64	-.05	
Occupational Specialties and		.52**
Rule Observation '67		.18

TABLE I (continued)

Partials	Program Innovation 1964-66	Program Innovation 1967-69
Participation and Hierarchy of Authority '64	.33 .10	
Participation and Hierarchy of Authority '67		.02 .45*
Participation and Job Codification '64	.32 -.13	
Participation and Job Codification '67		.12 .30
Participation and Rule Observation '64	.33 .01	
Participation and Rule Observation '67		.08 .21
Hierarchy of Authority and Job Codification '64	-.08 -.15	
Hierarchy of Authority and Job Codification '67		.43 -.22
Hierarchy of Authority and Rule Observation '64	-.07 -.03	
Hierarchy of Authority and Rule Observation '67		.42 -.04

* $p \leq .1$
** $p \leq .05$
*** $p \leq .01$
**** $p \leq .001$

TABLE II

RESOURCES AS PREDICTORS

Zero Order Correlations

Resources 1964	Program Innovation 1964-66
Professional Activity	.45*
Professional Training	-.07
Size	-.18
Resources 1967	**Program Innovation 1967-69**
Professional Activity	.42
Professional Training	.14
Size	.29

Partials	Program Innovation 1964-66	Program Innovation 1967-69
Professional Activity and Professional Training '64	.59** -.44*	
Professional Activity and Professional Training '67		.49* -.48*
Professional Activity and Size '64	.44* -.17	
Professional Activity and Size '67		.35 .16
Professional Training and Size '64	-.14 -.21	
Professional Training and Size '67		-.37 .18

TABLE III

ELITE ATTITUDES AS PREDICTORS

	Program Innovation 1964-66	Program Innovation 1967-69
Pro Change Attitude of Elite '64	.69***	
Pro Change Attitude of Elite '64		.43

TABLE IV

STRUCTURES VS. RESOURCES AS PREDICTORS

Dependent Variable: Innovation 1964-66

Independent Variables	Standardized Regression Coefficient	Partial Correlation Coefficient
Occupational Specialties '64	.54	.57**
Professional Activity '64	.27	.32
Multiple Coefficient of Determination (corrected)		.38**
Occupational Specialties '64	.70	.69***
Size '64	-.33	-.41
Multiple Coefficient of Determination (corrected)		.42**

Dependent Variable: Innovation 1967-69

Occupational Specialties '67	.43	.39
Professional Activity '67	.17	.16
Multiple Coefficient of Determination (corrected)		.20*
Occupational Specialties '67	.58	.47*
Size '67	-.08	-.07
Multiple Coefficient of Determination (corrected)		.18

TABLE V

STRUCTURES AND RESOURCES VS. ELITE ATTITUDES AS PREDICTORS

Dependent Variable: Innovation 1964-66

Independent Variables	Standardized Regression Coefficient	Partial Correlation Coefficient
Change Attitudes of Elite '64	.53	.64**
Occupational Specialties '64	.44	.56**
Multiple Coefficient of Determination (corrected)		.59***
Change Attitudes of Elite '64	.71	.68***
Size '64	.06	.08
Multiple Coefficient of Determination (corrected)		.40**
Change Attitudes of Elite '64	.67	.75***
Professional Activity '64	.41	.58**
Multiple Coefficient of Determination (corrected)		.60***

TABLE VI

STRUCTURE VS. RESOURCES VS. ELITE ATTITUDES AS PREDICTORS

Third Order Partial Correlations with Program Innovation 1964-66	
Change Attitudes of Elite '64	.71***
Professional Activity '64	.49*
Occupational Specialties '64	.48*
Multiple Coefficient of Determination (corrected)	.66***
Change Attitudes of Elite '64	.75***
Professional Activity '64	.58**
Size '64	.14
Multiple Coefficient of Determination (corrected)	.57***
Change Attitudes of Elite '64	.55**
Size '64	-.18
Occupational Specialties '64	.58**
Multiple Coefficient of Determination (corrected)	.57***
Size '64	-.39
Occupational Specialties '64	.64**
Professional Activity '64	.29
Multiple Coefficient of Determination (corrected)	.42**
Third Order Partial Correlations with Program Innovation 1967-69	
Size '67	-.07
Occupational Specialties '67	.37
Professional Activity '67	.16
Multiple Coefficient of Determination (corrected)	.13

TABLE VII

THE ROLE OF PREVIOUS PERFORMANCE IN PREDICTING INNOVATION

Independent Variables	Standardized Regression Coefficient	Partial Correlation Coefficient
Dependent Variable: Program Innovation 1964-1966		
History of Innovation '59-63	.42	.47*
Occupational Specialties '64	.43	.48*
Multiple Coefficient of Determination (corrected)		.46***
History of Innovation '59-63	.53	.52**
Professional Activity '64	.20	.22
Multiple Coefficient of Determination (corrected)		.33**
History of Innovation '59-63	.80	.76***
Size '64	-.48	-.57**
Multiple Coefficient of Determination (corrected)		.53***
History of Innovation '59-63	.50	.67***
Change Attitudes of Elite '64	.58	.73***
Multiple Coefficient of Determination (corrected)		.67****
Dependent Variable: Program Innovation 1967-69		
History of Innovation '64-66	.68	.68***
Occupational Specialties '67	-.04	-.06
Multiple Coefficient of Determination (corrected)		.30**
History of Innovation '64-66	.61	.52**
Professional Activity '67	.04	.04
Multiple Coefficient of Determination (corrected)		.30**
History of Innovation '64-66	.60	.62**
Size '67	.20	.26
Multiple Coefficient of Determination (corrected)		.35**

TABLE VII (continued)

Third Order Partial Correlations with Program Innovation 1964-66	
History of Innovation '59-63	.40
Occupational Specialties '64	.47*
Professional Activity '64	.18
Multiple Coefficient of Determination (corrected)	.43**
History of Innovation '59-63	.57**
Occupational Specialties '64	.40
Change Attitudes of Elite '64	.70***
Multiple Coefficient of Determination (corrected)	.70****
History of Innovation '59-63	.56**
Professional Activity '64	.39
Change Attitudes of Elite '64	.77***
Multiple Coefficient of Determination (corrected)	.70****

Third Order Partial Correlations with Program Innovation 1967-69	
History of Innovation '64-66	.44
Occupational Specialties '67	.25
Professional Activity '67	-.05
Multiple Coefficient of Determination (corrected)	.30*

APPENDIX

A. Structural Variables

1) Index of Complexity:

The count of occupational specialties is not based on the number of specific job titles. Instead, each respondent was asked what he did and then this was coded according to the kind of professional activity and whether it was a specialty. This procedure was used for two reasons. First it avoids the problem of task specialization where one activity may be divided into many specific and separate tasks. Second, it allows for comparability across organizations.

2) Index of Centralization:

a) participation in decision making

The index of actual participation in decision making was based on the following four questions: (1) How frequently do you usually participate in the decision to hire new staff? (2) How frequently do you usually participate in the decisions on the promotion of any of the professional staff? (3) How frequently do you participate in decisions on the adoption of new programs? (4) How frequently do you participate in decisions on the adoption of new policies? Respondents were assigned numerical scores from 1 (low participation) to 5 (high participation), depending on whether they answered "never," "seldom," "sometimes," "often," or "always," respectively, to these questions.

b) hierarchy of authority

The index of hierarchy of authority was developed from two scales developed by Richard Hall (1963, pp. 32-40). The index was computed by first averaging the replies of individual respondents to each of the following five statements: (1) There can be little action taken here until a supervisor approves a decision. (2) A person who wants to make his own decisions would be quickly discouraged here. (3) Even small matters have to be referred to someone higher up for a final answer. (4) I have to ask my boss before I do almost anything. (5) Any decision I make has to have my boss's approval. Responses could

vary from 1 (definitely false) to 4 (definitely true). The individual scores were then combined into an organizational score.

3) Index of Formalization:

a) job codification and rules

The index of job codification and rules was based on the following five questions: (1) I feel that I am my boss in most matters. (2) A person can make his own decisions without checking with anybody else. (3) How things are done here is left up to the person doing the work. (4) People here are allowed to do almost as they please. (5) Most people here make their own rules on the job. Replies to these questions were scored from 1 (definitely true) to 4 (definitely false), and then each of the respondents' answers were averaged. Thus, a high score on this index implies many rules and a high degree of job codification.

b) rule observation

The rule observation index was computed by averaging the responses to each of the following two statements: (1) The employees are constantly being checked on for rule violations. (2) People here feel as though they are constantly being watched to see that they obey all the rules. Respondents' answers were coded from 1 (definitely false) to 4 (definitely true), and then the average score of each respondent on these items was computed. On this index a high score means a high degree of rule observation.

B. Resource Variables

1) Index of Knowledge Inputs:

a) professional training

The index was scored as follows: (a) an absence of training beyond a college degree and the absence of other professional training received a score of 0. (b) an absence of training beyond college degree and the presence of other professional training received a score of 1. (c) some training beyond a college degree and the absence of other professional training received a score of 2. (d) training beyond a college degree and the presence of other professional training received a score of 3.

b) professional activity

The index of professional activity, which ranged from 0 to 3 points, was computed as follows: (a) 1 point for belonging to a professional organization. (b) 1 point for attending at least two-thirds of the previous six meetings of any professional organization. (c) 1 point for the presentation of a paper or holding of an office in any professional organization.

C. Elite Attitudes

1) Index of Elite Attitudes Favorable to Change:

This index was computed by averaging responses to each of the following items: (a) There is really something refreshing about enthusiasm for change. (b) If I were to follow my deep convictions, I would devote much time to change movements. This seems to me to be a primary need today. (c) The current situation in the community calls for change; we should do something now (we must respond at once). (d) If you want to get anywhere, it's the policy of the system as a whole that needs to be changed, not just the behavior of isolated individuals. (c) Any organizational structure becomes a deadening weight in time and needs to be revitalized.

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